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The *Leptogium juressianum* complex in southeastern Brazil

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Abstract— *Leptogium subjuressianum* and *L. subjuressianum* var. *caparoense* are new Brazilian taxa growing mostly in the southeastern mountains. They are differentiated from European taxa by the ornamentation of the upper surface.

Key words— lobules, margin, granular isidia

Introduction

Leptogium juressianum is the only species in *Leptogium* sect. *Mallotium* producing isidia-like structures and with hairs confined mostly to the upper surface (Jørgensen 1997, Tavares 1950). The other *Leptogium* species with hairs chiefly on the upper surface — *L. eriodermoides* Arv. & P.M. Jørg. and *L. resupinans* Nyl. (Jørgensen 1997) — do not have ornamented thalli.

Such hairs, initially observed by Tavares (1950), are commonly considered an important taxonomic characteristic and have a specific organization. However, the organization is rarely described in detail and sometimes not even mentioned (Swinscow & Krog 1988, Galloway & Jørgensen 1995).

Jørgensen & James (1983) described the hairs of *L. juressianum* as an arachnoid tomentum while Jørgensen (1997) called them cobwebby hairs. Tavares (1950) described the holotype from Portugal as producing isidiate or lacinulate propagules, but later specimens with alternative propagules were also identified as *L. juressianum*: cylindrical to complanate isidia and lacinulae were noted for Ethiopian (Africa) collections (Swinscow & Krog 1988), western European specimens produced granular to sublobulate isidia (Jørgensen & James 1983), and the upper surface of specimens from Chile were found to have granular, sublobulate, or lacinulate isidia and isidiate-lacerate lobe margins (Galloway & Jørgensen 1995).

Leptogium specimens collected during the first author's doctoral studies, were initially identified as *L. juressianum*. Upon type revision and under our descriptive protocol we discovered that the material represents new taxa, which are described here, together with comments on *L. juressianum*.

Material & methods

This study is mainly based on material collected in the Serra da Mantiqueira, a major mountain complex in southeastern Brazil, as well as on the isotype of *L. juressianum* (UPS). We were unable to study the holotype because the Museu Nacional de História Natural (LISU) in Lisboa, Portugal, did not respond to a loan request.

Comparative morphological and anatomical characteristics summarized in Table 1 are modeled after a table first assembled by Cunha (2007), who studied the *Leptogium* species collected in forests (mainly mangroves) and urban littoral habitats of São Paulo state. The character set has been modified to encompass the morphological variations we observed in the Serra da Mantiqueira taxa.

The nature of the thalline surfaces and their ornamentation are considered important taxonomic characters. The surfaces are described without and with magnification; the system of folds and/or wrinkles and their size is determined by complex organization of the hyphae (both cortical and internal), which remain constant in both dry and wet specimens. Some folds are readily seen with the naked eye, but smaller folds (≤ 0.1 mm, which appear smooth to the naked eye but can readily be seen under magnification ≥ 10×) must be observed under the stereomicroscope.

Several species apparently bear similar propagules on the upper surface, but careful observation has shown that their morphology and position are good species characters. Thus descriptions of their form, dimensions, distribution, and ontogeny are described in Table 1.

Table 1. Morphological comparison of *Leptogium juressianum*, *L. subjuressianum,* and *L. subjuressianum* var. *caparoense*.

Taxon	Ornamentation	Ornament distribution	Hair distribution	Dry thallus color*
L. juressianum	Cylindrical when young to flattened when fully developed	Usually on lobe margins	Upper surface; parts of underside	Gray to bluish where glabrous
L. subjuressianum var. *subjuressianum*	Granular isidia and lobules	Usually on lobe margins	Upper surface and usually on underside margin	Brownish where glabrous
L. subjuressianum var. *caparoense*	Granular isidia	Abundant on lamina; frequent on lobe margins	Frequent on upper surface; abundant on underside	Dark brown to blackish where glabrous

* All whitish where hairy

All specimens analyzed were dissected under a stereomicroscope with a razor blade and the semi-permanent slides were mounted with solution of 50% glycerine.

Results & discussion

The name *Leptogium juressianum* has been attributed to all ornamented (bearing isidia-like or lobule-like structures) specimens of *Leptogium* that develop hairs mostly on the upper surface (Tavares 1950, Jørgensen & James 1983, Jørgensen & Nash 2004). The detailed descriptions of thallus and ornamentation produced according to our protocols have enabled us to distinguish the Brazilian taxa. This was not possible using brief descriptions and the characters commonly used to describe and differentiate *Leptogium* species. Thallus color, hair distribution, and the nature of the vegetative propagules are the principal diagnostic characters in this paper (Table 1).

Leptogium juressianum Tav., Port. Acta Biol., Ser. B, 3: 68, 1950. Figs 1–2

Type: **PORTUGAL**, Minho [corresponding with the modern districts of Braga and Viana do Castelo], Serra do Gêres, between Pedra Bela and the Caldas, 700 m alt., on *Arbutus unedo*, 16.VI.1947, leg. C. Tavares 2081 (**holotype**, LISU; **isotype**, UPS!).

Thallus gray, opaque, matt, gray to whitish when observed under the stereomicroscope. Lobes irregularly lacerate, to 3 mm wide, overlapping, attached in points, convolute, upper surface smooth and velvety under the naked eye, pubescent at 10× and higher magnifications (interlaced hairs that are similar to sponge fibers); apices rounded, usually ascending to involute, smooth or isidiate to lacinulate; lateral margin fimbriate (isidiate to lacinulate), ascending, irregular; lower side bluish gray, smooth at different magnifications. Isidia absent. Lacinules smooth, cylindrical when young to flattened, ca. 0.08–0.30 × 0.03–0.08 mm, unbranched to irregularly branched but not coralloid, erect, firm, concolorous with the thallus, usually marginal, dense, frequent to abundant, grouped on the lamina. Attached by hairs; rhizines absent; hapters absent; hairs irregular, unbranched or branched, up to 125 µm (ca. 9 cells) long, dense on upper surface, frequent on lower side. Apothecia absent.

Anatomy— thallus ca. 60 µm thick, quadratic cells of the cortices ca. 7.5 × 5.0 µm; columnar hyphae ca. 2.5 µm thick, straight to inclined, 2(–3) cells. Cyanobacteria blue, frequent to abundant, cell number not appraised, spherical, 5 µm diam.; gelatinous matrix poor, hyaline. Pycnidia absent.

Comments— *Leptogium juressianum* is characterized by the isidiate to lacinulate margins and hairs on the upper surface.

Originally described from Portugal, the species has been cited for western Europe (Jørgensen & James 1983), southern Africa (Swinscow & Krog 1988), and Chile, South America (Galloway & Jørgensen 1995), but always with different type and/or position of propagules. Since the propagules are major

diagnostic characters, we believe the previously cited collections may represent different taxa and that all that material needs re-evaluation

Leptogium subjuressianum Marcelli & Kitaura**, sp. nov.** Figs 3–4

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Differs from *Leptogium juressianum* by granular isidia and presence of rounded lobules.

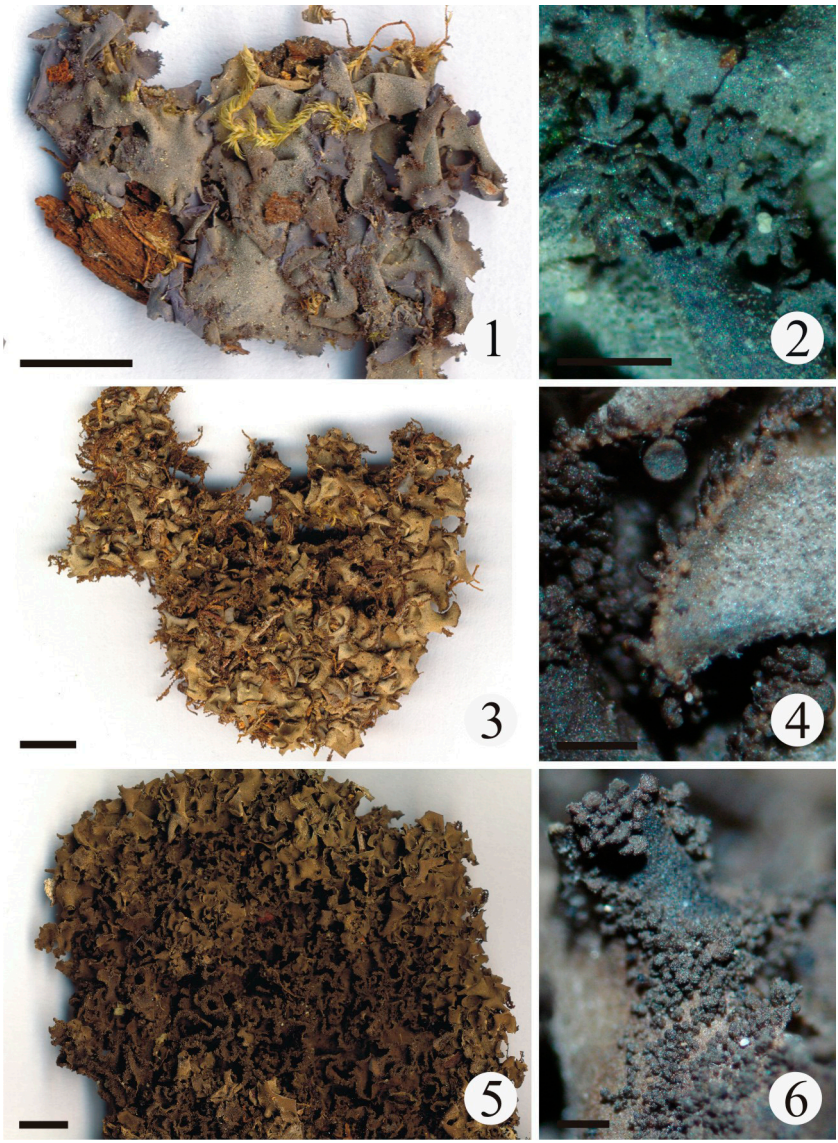
Type: Brazil, Rio Grande do Sul State, municipality of Tapes, on trunk of a tree, 5 m alt, 29.I.1994, leg. M.P. Marcelli 26459 (**holotype**, SP).

Etymology: The specific epithet refers to the closely related species, *L. juressianum*, the name first applied to the studied material.

Thallus whitish or black (naked eye), opaque, matt, whitish brown when observed under the stereomicroscope. Lobes to 2 mm wide, irregularly overlapping, attached in points, ascending; upper surface velvety when observed with the naked eye, pubescent at 10× and higher magnifications; apices rounded, ascending, involute to convolute, ornamented with small granular to lobulate isidia; lateral margins lobulate, ascending or flat, undulate; lower side bluish gray, smooth, covered by long hairs seen at 10× and higher magnification. Isidia granular, ca. 0.05 mm diam., unbranched, erect, firm, concolorous with the thallus, rare on the lamina but dense at the margins. Lobules with apices rounded, ca. 0.5 mm diam., unbranched, erect, firm, concolorous with the thallus, marginal, dense, abundant. Attached by rhizines and hairs; hapters absent; rhizines unbranched, beige, evenly distributed, frequent, formed from agglutinated hairs; hairs interlaced, unbranched or branched, ≤ 125 µm (ca. 8 cylindrical cells) long, beige, present on both surfaces, abundant on the upper surface and frequent on the lower surface. Apothecia absent.

Anatomy— thallus ca. 55 µm thick, upper quadratic cells ca. 10 × 10 µm, lower quadratic cells ca. 5 × 5 µm, columnar hyphae ca. 2.5 µm thick, straight and inclined, comprising 3–4 cells. Cyanobacteria blue, frequent, cell number not appraised, cells spherical, ca. 5 µm diam.; gelatin frequent, colorless. Pycnidia absent.

Additional material examined: **BRAZIL**. **Paraná State**, General Carneiro Municipality, Fazenda Lageado Grande, s/d, S. Eliasaro 2892 (UPCB); **São Paulo State**, Campos do Jordão Municipality, Parque Estadual de Campos do Jordão, *Araucaria*/*Podocarpus* forest, on tree trunk inside the forest, 1400 m alt., 17.VI.1995, M.P. Marcelli, A. Gugliotta & R. Maziero 28914 (SP); **Minas Gerais State**, Camanducaia Municipality, on trunk, 21.XI.2008, M.J. Kitaura, M.P. Marcelli, A.E. Luchi & S.N. Inoue 1158 (SP), 1179 (SP); 22.XI.2008, M.J. Kitaura, M.P. Marcelli, A.E. Luchi & S.N. Inoue 1232 (SP), 1235 (H); Itamonte Municipality, BR-485, on trunk, 22.I.2009, M.J. Kitaura & M.P. Marcelli 1468 (SP); Brejo da Lapa, on trunk, 23.I.2009, M.J. Kitaura & M.P. Marcelli 1536 (SP); **Espírito Santo State**, Dores do Rio Preto Municipality, on trunk, 16.IX.2009, M.J. Kitaura & M.P. Marcelli 1792 (SP), 1804 (SP), 1825 (BOTU); on branch fallen on the rock, 16.IX.2009, M.J. Kitaura & M.P. Marcelli 1911 (SP).



Figures 1–6. *Leptogium juressianum* (isotype, UPS): 1. Thallus; 2. Propagules. *L. subjuressianum* var. *subjuressianum* (holotype): 3. Thallus; 4. Propagules. *L. subjuressianum* var. *caparoense* (holotype): 5. Thallus; 6. Propagules. Scale bars: 1, 3, 5 = 5 mm; 2, 4, 6 = 20 μm.

Comments— *Leptogium subjuressianum* is characterized by the rounded lobules on the thallus margin and spongioid hairs on the upper surface, which usually appears whitish due to the presence of dense hairs. Both *L. juressianum* and *L. subjuressianum* are covered by a dense layer of spongioid hairs, which are interlaced and resemble fibers of sponges.

According to Tavares (1950), *L. juressianum* possesses only isidia and lacinules on the margins. No rounded lobules were observed in any part of the isotype. We did not find lacinules in any specimens of *L. subjuressianum*, where only granular to lobulate isidia are present prior to the development of lobules.

Leptogium subjuressianum is common in Brazil and is usually collected on tree trunks. Specimens were collected from Tapes Municipality, Rio Grande do Sul State (30°40′12″S 51°23′24″W) to Alto Caparaó Municipality in Minas Gerais State (20°29′42″S 41°59′54″W).

Leptogium subjuressianum* var. *caparoense Kitaura & Marcelli, **var. nov.**

MycoBank 563862 Figs 5–6

Differs from *Leptogium subjuressianum* var. *subjuressianum* by the isidia distribution and the presence of rhizomorphic hyphae on the lower surface.

Type: Brazil, Minas Gerais State, Municipality of Alto Caparaó, Cachoeira Bonita, on organic material on rock beside the waterfall, 17.IX.2009, leg. M.J. Kitaura & M.P. Marcelli 1900 (**holotype**, SP; **isotypes**, H).

Etymology: The varietal epithet refers to the Caparaó Range, a major mountain complex in southeastern Brazil where the types were collected.

Thallus whitish to blackish (naked eye), opaque, matt, whitish (hairy part) and dark brown or black (glabrous part) when observed under the stereomicroscope. Lobes to 3 mm wide, irregular, overlapping, attached in points, ascending, upper surface smooth or velvety when observed with the naked eye, pubescent, smooth or ornamented at 10× and higher magnifications; apices rounded, ascending or involute, usually smooth; lateral margins smooth to granular, ascending, undulate; lower side usually brownish, with adhering substrata when observed with the naked eye, smooth or less pubescent that upper surface at 10× and higher magnifications. Isidia granular, ca. 0.1 mm diam., concolorous with the thallus, firm, dense or abundant on the lamina and frequent at the margins. Lobules rounded, ca. 0.5 mm diam., unbranched, erect, firm, concolorous with the thallus, marginal when the thallus is covered by hairs, frequent or rare on the lamina. Attached by rhizines and hairs; hapters absent; rhizines unbranched, beige, evenly distributed, frequent, constituted from agglutinated hairs; hairs interlaced, irregular, beige, dense on upper surface and frequent on lower surface, cells cylindrical. Apothecia absent.

Anatomy— thallus ≤ 70 µm thick, upper quadratic cells (wall slightly blackish) ca. 10 × 10 µm, lower quadratic cells ca. 7.5 × 7.5 µm; columnar hyphae

ca. 2.5 µm thick, straight to inclined, 4-celled. Cyanobacteria yellow to slight blue, frequent, cells spherical, ca. 5 µm diam.; gelatin frequent to scarce, yellow next to upper cortex and colorless below. Pycnidia absent.

Additional material examined: **BRAZIL**, **Minas Gerais State**, Alto Caparaó Municipality, Cachoeira Bonita, saxicolous, 17.IX.2009, M.J. Kitaura & M.P. Marcelli 1902 (H), 1905 (SP); on the moss on the rock, 17.IX.2009, M.J. Kitaura & M.P. Marcelli 1904 (SP), 1932 (BOTU).

Comments— *Leptogium subjuressianum* var. *caparoense* is characterized by granular isidia on both the lamina and margins (older parts) and the blackish or dark brown colored thallus (when not covered by spongioid hairs).

The lobules common on the margins of *L. subjuressianum* var. *subjuressianum* were not observed in *L. subjuressianum* var. *caparoense* (Table 1).

Furthermore, the isidia in *L. subjuressianum* var. *caparoense* are mainly laminal but primarily marginal in *L. subjuressianum* var. *subjuressianum*. Also, *L. subjuressianum* var. *caparoense* has rhizomorphic hyphae covering the entire lower surface whereas in var. *subjuressianum* they are present mainly at the margins of the lobes.

All specimens of *L. subjuressianum* var. *caparoense* were collected in an especially humid place on wet rocks beside a waterfall inside Caparaó National Park. We attribute to this the abundance of rhizomorphic hyphae and spreading of the propagules and hairs and prefer to retain the taxon at the varietal level.

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